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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: William J. Schaff et al.

Title: AlN COATED HETEROJUNCTION FIELD EFFECT TRANSISTOR AND METHOD OF FORMING AN AlN COATING

Docket No.: 1153.044US1
Filed: May 15, 2001
Examiner: Khanh B. Duong

Serial No.: 09/858,337
Due Date: June 28, 2006
Group Art Unit: 2822

MS Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
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Name

Dawn M. Pole
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SUBSTITUTE APPEAL BRIEF UNDER 37 C.F.R. § 41.37

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: William J. Schaff et al. Examiner: Khanh B. Duong

Serial No.: 09/858,337 Group Art Unit: 2822

Filed: May 15, 2001 Docket: 1153.044US1

For: AlN COATED HETEROJUNCTION FIELD EFFECT TRANSISTOR AND METHOD OF FORMING AN AIN COATING

SUBSTITUTE APPEAL BRIEF UNDER 37 CFR § 41.37

Mail Stop Appeal Brief- Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The Substitute Appeal Brief is presented in support of the Notice of Appeal to the Board of Patent Appeals and Interferences, filed on November 23, 2005, from the Final Rejection of claims 1-19 of the above-identified application, as set forth in the Final Office Action mailed on June 6, 2005.

The Commissioner of Patents and Trademarks is hereby authorized to charge Deposit Account No. 19-0743 in the amount of $250.00 which represents the requisite fee set forth in 37 C.F.R. § 41.2(b)(2). The Appellants respectfully request consideration and reversal of the Examiner's rejections of pending claims.

1. REAL PARTY IN INTEREST

The real party in interest of the above-captioned patent application is the assignee, CORNELL RESEARCH FOUNDATION, INC..

2. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to Appellant that will have a bearing on the Board's decision in the present appeal.

3. STATUS OF THE CLAIMS

The present application was filed on December 31, 2002 with claims 1-30. A non-final Office Action mailed June 10, 2002 in which claims were restricted and all rejected. A second non-final Office Action was mailed November 2, 2002 rejecting claims 1-19. A third non Final Office Action was mailed May 8, 2003 rejecting claims 1-19. A Final Office Action was mailed December 3, 2003 rejecting claims 1-19. An Advisory Action was mailed April 2, 2004, rejecting claims 1-19. An Appeal Brief was filed August 3, 2004. A non-final Office Action was mailed on November 12, 2004, rejecting claims 1-19. A Final Office Action was mailed on June 6, 2005, rejecting claims 1-9 and 11-15, allowing claims 17-19 and objecting to claim 10 and 16. Claims 1-9 and 11-15 stand twice rejected, remain pending, and are the subject of the present Appeal. Claims 17-19 are allowed and claims 10 and 16 are objected to and are not the subject of the present appeal.

4. STATUS OF AMENDMENTS

An amendment was submitted after the Final Rejection mailed June 6, 2005, but was not entered.

5. SUMMARY OF CLAIMED SUBJECT MATTER

Claim 1 recites a method of forming a field effect transistor (10) involves forming a channel heterojunction field effect transistor having a top surface. An AlN passivation layer (32) is applied to the top surface (16) of the heterojunction channel field effect transistor. The fabrication of the transistor (10) is described starting on page 5, line 22, with reference to FIG.S 1-9. The AlN passivation layer (32) is described on page 6, starting at line 10. The structure of an AlN passivation layer (32) applied to the top surface of the transistor my result in an approximately doubling of the power output of a heterojunction channel field effect transistor as indicated at page 4, lines 4-6. This may be due to chemical bonds between AlN and the heterostructure serving to change the charge state of dangling bonds, or other surface electrochemical properties. The specific surface bonding of AlN to the transistor surface controls surface carrier motion. AlN minimizes or eliminates this parasitic charge motion which otherwise may lead to a large variety of problems including frequency dispersion of operational parameters, noise generation, non-linear gain, intermodulation distortion, etc. In claim 2, the AlN layer is between approximately 500 and 2000 Angstrom as described at page 3, lines 27-30..

In claim 3, the AlN layer may be formed by alternately applying Al and N until a desired thickness of AlN is obtained. Claim 4 recites that a predetermined amount of time occurs between each alternate application. See page 8, lines 3-29.

Claim 5 is an independent claim that recites a method of forming a field effect transistor (10) by forming a heterojunction channel field effect transistor having a top surface (16), and applying an AlN passivation layer (32) to the top surface of the heterojunction channel field effect transistor using molecular beam epitaxy. Dependent claims 6-9 are similar to the claims depending from claim 1. Claim 10 further recites that beams of Al and N are applied at approximately 150 degrees Celsius. See page 8, lines 3-29.

Independent claim 11 recites a method of forming a layer of AlN (32) of desired thickness on a semiconductor substrate (16) using molecular beam epitaxy to apply beams of Al and beams of remote plasma RF nitrogen alternately with the beams of AL

to produce the layer of AlN of desired thickness. In claim 12, the beams are alternately applied for approximately two seconds until the desired thickness is obtained. Page 8, lines 22-29. In claim 14, the beams are alternately applied for approximately two seconds, and the delay is also approximately two seconds between the alternating beams until the desired thickness is obtained. Page 8, lines 22-29.

Independent claim 17 recites a method of forming a layer of AlN (32) of desired thickness on a semiconductor substrate (16) using molecular beam epitaxy at a temperature less than approximately 300 degrees Celsius. Repeated applications of beams of Al and RF nitrogen with waiting periods between produce the layer of AlN of desired thickness. Dependent claims are similar to those depending from claim 1.

This summary does not provide an exhaustive or exclusive view of the present subject matter, and Appellant refers to the appended claims and its legal equivalents for a complete statement of the invention.

6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claim 1 was rejected under 35 U.S.C. § 102(b) as being anticipated by Huang et al. (U.S. 5,719,088).

Claims 2, 5 and 9 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Huang in view of Yoshida (U.S. 6,281,099).

Claims 3 and 4 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Huang in view of Parmenter et al. (U.S. 5,026,454).

Claims 6-8 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Huang in view of Yoshida as applied to claims 2, 5 and 9 above, and further in view of Parmenter.

Claims 11-15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Utumi in view of Parmenter and Yoshida.

7. ARGUMENT

A) Rejections Under 35 U.S.C. § 102: The Applicable Law

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *M.P.E.P. ' 2131.* To anticipate a claim, a reference must disclose every element of the challenged claim and enable one skilled in the art to make the anticipating subject matter. *PPG Industries, Inc. V. Guardian Industries Corp.*, 75 F.3d 1558, 37 USPQ2d 1618 (Fed. Cir. 1996). The identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

B) Discussion of the rejection of claim 1 under 35 U.S.C. § 102(b) as being anticipated by Huang et al. (U.S. 5,719,088).

Claim 1

Claim 1 was rejected under 35 USC § 102(b) as being anticipated by Huang et al. (U.S. Patent No. 5,719,088). This rejection is respectfully traversed, Appellant respectfully submits that the Final Office Action has made an improper prima facie showing of anticipation at least because Huang et al. fails to teach " applying an AlN passivation layer to the top surface of the heterojunction channel field effect transistor."

Thus, because Huang et al., fails to teach each and every element of claim 1, Appellant respectfully requests reversal of the § 102(b) rejections.

Huang et al. indicates that layer 25 is AlN, but this is never used as a passivation layer, it is only used as an etch stop layer in an intermediate processing step. As such, it is a process tool. No other functions are ascribed to it. In fact, Huang et al. indicate specifically that layer 35, as seen in FIG. 5, formed beneath the AlN layer 25 is a passivating layer. The function of this layer is described in Col. 4, lines 10-35. At line 26, Huang et al., states: "Passivating film 35 provides consistent device operation,

improved device characteristics, and better reliability than any of the previously used passivating dielectric layers which are deposited on the surface of the substrate so as to surround the electrode area."

Typical examples of passivating film 35 in Huang et al., are provided at lines 18 and 19: "...specific examples of which are gallium sulfide (GaS), gallium fluoride (GaF_3), and ammonium sulfide ($(NH_4)_2S$)." Not only is the layer 25 not a passivating film, the passivating film described in Huang et al. is very different from the AlN passivating layer claimed. Huang thus actually teaches away from having AlN function as a passivation layer. He describes it as an etch stop. The AlN layer of Huang et al. is clearly not a passivating layer as claimed and simply does not teach what the Office Actions indicate it teaches. As such, a prima facie case of anticipation has not been established, and the rejection should be reversed.

The Examiner mentions that in FIG. 2 of Huang et al., the AlN layer 25 is formed on a top surface of the HFET. This assertion is respectfully traversed. The AlN layer 25 in Huang et al., is formed over an insulating layer 22, and is not a passivating layer as claimed.

In the first Advisory Action, the Examiner states that "the features recited in claim 1 do not prevent the passivation layer from forming on top of other layers." Applicant respectfully disagrees. The passivation layer described in the specification is formed directly on top of the HFET, and not on additional layers. The specification makes it clear that the passivation layer alters the electronic properties of the surface of the transistor, and thus is referred to as a passivation layer. While the Office Action may imply that the AlN layer 25 in Huang et al. is applied to a transistor, the claim language quite clearly distinguishes it by indicating that the AlN is a passivation layer applied to a top surface of the HFET. Huang et al. itself describes that a passivation layer is formed on the substrate, which functions as the active area of the transistor, but describes the use of a very different material as the passivation layer.

An AlN passivation layer, as used in the present application, alters the electronic properties of the surface of the transistor. The claimed structure specifically points out that the layer is applied to the top surface of the transistor. Given such a structure, the

AlN passivation layer functions to stop the uncontrolled changing of charge states at the surface during the operation of the transistor. These charge states may be due to dangling bonds, impurities, or other defects. The surface states are being controlled by this layer to be electronically passive, in contrast to being uncontrollably active. Claim 1 clearly recites a different structure than Huang et al., and the rejection should be reversed.

The Examiner's Answer continues to assert that the AlN layer 25 in Huang et al. is a "passivation" layer as indicated on page 3 : "Since the AlN etch stop layer of 25 also functions as a protective layer for the layers below during the etching process as previously disclosed, it is appropriate to refer to such layer as a "passivation layer"." This assertion is respectfully traversed. It is inconsistent with the teaching of Huang et al., and of the present application. Huang et al., describe a passivating layer as a layer that affects the electrical characteristics of the layer it is formed on. Huang et al. indicate specifically that layer 35, as seen in FIG. 5, formed beneath the AlN layer 25 is a passivating layer. The function of this layer is described in Col. 4, lines 10-35. At line 26, Huang et al., states: "Passivating film 35 provides consistent device operation, improved device characteristics, and better reliability than any of the previously used passivating dielectric layers which are deposited on the surface of the substrate so as to surround the electrode area.". In contrast, AlN layer 25 is described as an etch stop, and is not described as providing any passivating functions. It is clearly not a passivation layer as that term is used consistently in both Huang et al., and the present application. It is not appropriate to refer to AlN layer 25 as a passivation layer, and the rejection should be reversed.

C) Rejections Under 35 U.S.C. § 103. The Applicable Law

The Examiner has the burden under 35 U.S.C. 103 to establish a *prima facie* case of obviousness. *In re Fine*, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). As part of establishing a *prima facie* case of obviousness, the Examiner must show that some objective teaching in the prior art or some knowledge generally available to one of ordinary skill in the art would lead an individual to combine the relevant teaching of the references. *Id.*

The court in *Fine* stated that:

> Obviousness is tested by "what the combined teaching of the references would have suggested to those of ordinary skill in the art." *In re Keller*, 642 F.2d 413, 425, 208 USPQ 871, 878 (CCPA 1981)). But it "cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination." *ACS Hosp. Sys.*, 732 F.2d at 1577, 221 USPQ at 933. And "teachings of references can be combined *only* if there is some suggestion or incentive to do so."

Id. (emphasis in original).

> The M.P.E.P. adopts this line of reasoning, stating that
> "In order for the Examiner to establish a *prima facie* case of obviousness, three base criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Appellant s disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed.Cir. 1991))". *M.P.E.P.* 2142

The test for obviousness under § 103 must take into consideration the invention as a whole; that is, one must consider the particular problem solved by the combination of elements that define the invention. *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1143, 227 USPQ 543, 551 (Fed. Cir. 1985). The Examiner must, as one of the inquiries pertinent to any obviousness inquiry under 35 U.S.C. § 103, recognize and consider not only the similarities but also the critical differences between the claimed invention and the prior art. *In re Bond*, 910 F.2d 831, 834, 15 USPQ2d 1566, 1568 (Fed. Cir. 1990), *reh'g denied*, 1990 U.S. App. LEXIS 19971 (Fed. Cir. 1990). Finally, the Examiner must avoid hindsight. *Id.*

The Office Action must provide specific, objective evidence of record for a finding of a suggestion or motivation to combine reference teachings and must explain the reasoning by which the evidence is deemed to support such a finding. *In re Sang Su Lee*, 277 F.3d 1338, 61 USPQ2d 1430 (Fed. Cir. 2002).

D) Discussion of the Rejection of the Claims 2, 5 and 9 under 35 U.S.C. § 103(a) as being unpatentable over Huang et al. in view of Yosida (U.S. 6,281,099).

Claim 2

Claims 2, 5 and 9 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Huang in view of Yoshida (U.S. 6,281,099). This rejection is respectfully traversed. Claims 2-10 also include the formation of the AlN passivation layer to the top surface of the heterojunction channel field effect transistor and are believed to distinguish the references for at least the same reasons. Neither reference describes the formation of an AlN passivation layer regardless of thickness of the layer as claimed in claim 2. Further, since neither reference teaches that function for AlN, the thicknesses described in a reference are irrelevant to the thickness of an AlN passivation layer. The use of MBE for forming an AlN passivation layer is also not shown in either of the references.

Claim 5

While Yoshida discloses the use of MBE to form an AlN layer, it does not do so for a passivation layer as claimed in claim 5.

Claim 9

Claim 9 depends from claim 5, and also describes a thickness of 500 angstrom. Again, neither reference describes an AlN passivation layer, and thus whatever thickness they describe for an AlN layer does not render claim 9 obvious.

E) Discussion of the Rejection of the Claims 3 and 4 under 35 U.S.C. § 103(a) as being unpatentable over Huang et al. in view of Parmenter et al. (U.S. 5,026,454).

Claims 3 and 4

Claims 3 and 4 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Huang in view of Parmenter et al. (U.S. 5,026,454). This rejection is respectfully traversed. Claims 2-10 also include the formation of the AlN passivation layer on the top

surface of the heterojunction channel field effect transistor and are believed to distinguish the reference for at least the same reasons.

Parmenter et al. is cited as providing teaching of alternately opening and closing sources, and that it would have been obvious to use the Parmenter et al., teaching to modify the process of Huang to achieve accurate dosage of material at the substrate. However, it should be noted that Parmenter et al., describes "...several beam sources each having such a shutter and control mechanism, as may be required for dosing a substrate with several materials in sequence, or simultaneously." Col. 5, lines 6-9. There is no discussion of forming a compound material, such as an AlN layer. Language in Col. 2, lines 52-65 cited in the last Final Office Action describes alternately opening and closing a single shutter, not alternating between two shutters to form a compound such as AlN. Thus, even the combination of references does not disclose the recited method of claim 3, "wherein Al and N are applied alternately until a desired thickness of AlN is obtained." As such, the rejection should be reversed.

Claim 4 should depend from claim 3, and will be amended to do so at a future date. Claim 4 also discusses a particular algorithm in applying the alternate beams, wherein "a predetermined amount of time occurs between each alternate application." No teaching of this algorithm was found in the references.

F) Discussion of the Rejection of the Claims 6-8 under 35 U.S.C. § 103(a) as being unpatentable over Huang et al. in view of Yosida (U.S. 6,281,099), and further in view of Parmenter.

Claims 6-8 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Huang in view of Yoshida as applied to claims 2, 5 and 9 above, and further in view of Parmenter. This rejection is respectfully traversed. Claims 2-10 also include the formation of the AlN passivation layer on the top surface of the heterojunction channel field effect transistor and are believed to distinguish the references for at least the same reasons.

Claims 6-8 depend from claim 5, and are also believed to distinguish from the references for at least the same reasons as claim 5 above.

Claim 6

The last Final Office Action indicates that Parmenter teaches alternatively applying beams for approximately 0.2 seconds or less at Col. 2, lines 52-65. As previously indicated, the referenced langauge in Parmenter describes opening and closing a single shutter, not alternate shutters as described by the Examiner. The description in Pamenter et al., that the shutters may remain open for any length of time required by the deposition process does not teach a length that is used for forming an AlN layer. Most of Col. 2 refers to controlling how fast the shutter opens and closes, so that it slows down prior to being fully open or fully closed so that it is essentially stopped at the fully open or closed position. This may prevent undue vibrations from a hard closing or opening, which could loosen contamination from walls of the chamber. It clearly does not describe a length of time that a shutter is open as claimed in claim 6, wherein the beams are alternatively applied for approximately two seconds. Again, this value faciltates the formation of a compound layer of AlN, and is not taught or suggested by the references.

Claim 7

Claim 7 depends from claim 6 and distinguishes the references for at least the same reasons. It further recites a delay between alternate applications of the beams. As with claim 4 above, none of the references teach or suggest such a delay.

Claim 8

Claim 8 depends from claim 7 and distinguishes the references for at least the same reasons. It further describes the lengths of time during which beams are alternately applied as well as the delay itself. None of the references describe such times. In particular, none of the references describe such times with respect to the formation of an AlN passivation layer applied to the top surface of a transistor as claimed.

G) Discussion of the Rejection of the Claims 11-15 under 35 U.S.C. § 103(a) as being unpatentable over Utumi (U.S. 5,571,603) in view of Parmenter and Yoshida.

Claims 11-15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Utumi in view of Parmenter and Yoshida.

Claim 11

Utumi is sited as disclosing a method of forming an AlN layer of desired thickness using MBE, but fails to disclose alternatively applying the beams of remote plasma RF nitrogen and the beams of Al at specific process parameters such as time and thickness as claimed, per the last Final Office Action. Applicant agrees with this assessment.

The Final Office Action goes on to state that Parmenter et al. teaches an MBE apparatus that utilizes shutters 21 and 24 alternately applied for 0.2 seconds or less for any length of time required by the deposition process. The description in Pamenter et al., that the shutters may remain open for any length of time required by the deposition process does not teach a length that is used for forming an AlN layer. There is no discussion in Parmenter et al., of alternatively applying different beams to arrive at a two compound layer, such as AlN. Yoshida is cited only a describing an AlN layer formed using MBE having a thickness between 50 to 10,000 angstroms. Thus, even if the references are combined, they do not teach or suggest the invention as claimed.

The references are not properly combinable. Parmenter makes no mention of Al and RF nitrogen being alternated. Effectively, the rejection merely takes note that it is known that beams can be alternated by Parmenter. No suggestion from the references is found to make the combination of Utumi, Parmenter and Yoshida. The Examiner indicates that it would have been obvious to modify the process of Utumi with Parmenter to achieve more accurate dosages. However, there is no suggestion from the references that Utumi desired more accurate dosages. References cannot be combined just because they exist. There must be some suggestion in the art for that combination.

The Office Action must provide specific, objective evidence of record for a finding of a suggestion or motivation to combine reference teachings and must explain the reasoning by which the evidence is deemed to support such a finding. *In re Sang Su Lee*, 277 F.3d 1338, 61 USPQ2d 1430 (Fed. Cir. 2002). The Office Action stated "It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Utumi with the teaching of Parmenter, since Parmenter states at column 1, line 34-35 that such modification would achieve accurate dosage of material at the substrate." Since there is no suggestion that Utumi desired such accuracy, this is a mere conclusory statement of subjective belief. Applicant respectfully submits that the Office Action has not provided objective evidence for a suggestion or motivation to combine the references.

Since a proper prima facie case of obviousness has not been established, the rejection should be reversed.

The Examiner's Answer appears to assume that since Parmenter et al. teaches shutters that can be alternatively opened and closed, that it would be known that AlN would form when alternating beams of Al and N. This teaching is lacking from the references, and hence there is no assurance of success in combining Utumi and Parmenter et al., other than that provided by the present application. Both Utumi and Yoshida describe using beams of N and Al together, thus teaching away from alternating the beams. There is no teaching that alternating beams of Al and N will result in an AlN layer, nor is there any suggestion for trying such a method other than a machine exists which is capable of alternating beams. Thus, the combination of references fails to teach the claimed formation of an AlN layer by alternating beams of Al and N.

Claim 12

Claim 12 depends from claim 11 and distinguishes the references for at least the same reasons. Claim 12 describes that the beams are alternately applied for approximately two seconds. The description in Pamenter et al., that the shutters may remain open for any length of time required by the deposition process does not teach a

length that is used for forming an AlN layer, and does not describe alternating the beams as claimed.

Claim 13

Claim 13 depends from claim 11 and distinguishes the references for at least the same reasons. It further recites a delay between alternate applications of the beams. As with claim 4 above, none of the references teach or suggest such a delay.

Claim 14

Claim 14 depends from claim 13 and distinguishes the references for at least the same reasons. Claim 14 describes that the beams are alternately applied for approximately two seconds. The description in Pamenter et al., that the shutters may remain open for any length of time required by the deposition process does not teach a length that is used for forming an AlN layer, and does not describe alternating the beams as claimed.

Claim 15

Claim 15 depends from claim 11 and distinguishes the references for at least the same reasons. Claim 15 describes a thickness of 500 angstrom. None of the references describe an AlN passivation layer, and thus whatever thickness they describe for an AlN layer does not render claim 15 obvious.

8. SUMMARY

For the reasons argued above, the claims were not properly rejected.

It is respectfully submitted the claims are patentable over the cited art. Reversal of the rejection and allowance of the pending claim are respectfully requested.

Respectfully submitted,

WILLIAM J. SCHAFF et al.

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Dawn M. Poole
Name

Dawn M. Poole
Signature

CLAIMS APPENDIX

1. (Rejected) A method of forming a field effect transistor, the method comprising:

forming a channel heterojunction field effect transistor having a top surface; and

applying an AlN passivation layer to the top surface of the heterojunction channel field effect transistor.

2. (Rejected) The method of claim 1 wherein the thickness of the AlN layer is between approximately 500 and 2000 Angstrom.

3. (Rejected) The method of claim 1 wherein Al and N are applied alternately until a desired thickness of AlN is obtained.

4. (Rejected) The method of claim 1 wherein a predetermined amount of time occurs between each alternate application.

5. (Rejected) A method of forming a field effect transistor, the method comprising:

forming a heterojunction channel field effect transistor having a top surface; and

applying an AlN passivation layer to the top surface of the heterojunction channel field effect transistor using molecular beam epitaxy.

6. (Rejected) The method of claim 5 wherein applying AlN comprises alternating beams of Al and RF nitrogen, wherein the beams are alternately applied for approximately two seconds until the desired thickness is obtained.

7. (Rejected) The method of claim 6 and further comprising delaying a predermined amount of time between the alternating beams.

8. (Rejected) The method of claim 7 wherein the beams are alternately applied for approximately two seconds, and the delay is also approximately two seconds between the alternating beams until the desired thickness is obtained.

9. (Rejected) The method of claim 5 wherein the AlN is applied to a desired thickness is approximately 500 Angstrom.

10. (Cancelled)

11. (Rejected) A method of forming a layer of AlN of desired thickness on a semiconductor substrate, the method comprising:

using molecular beam epitaxy:

applying beams of Al; and

applying beams of remote plasma RF nitrogen alternately with the beams of AL to produce the layer of AlN of desired thickness.

12. (Rejected) The method of claim 11 wherein the beams are alternately applied for approximately two seconds until the desired thickness is obtained.

13. (Rejected) The method of claim 11 and further comprising delaying a predermined amount of time between the alternating beams.

14. (Rejected) The method of claim 13 wherein the beams are alternately applied for approximately two seconds, and the delay is also approximately two seconds between the alternating beams until the desired thickness is obtained.

15. (Rejected) The method of claim 11 wherein the desired thickness is approximately 500 Angstrom.

16. (Rejected) The method of claim 11 wherein the beams are applied at approximately 150 degrees Celsius.

17. (Rejected) A method of forming a layer of AlN of desired thickness on a semiconductor substrate, the method comprising:

using molecular beam epitaxy at a temperature less than approximately 300 degrees Celsius:

applying a beam of Al;

waiting a predetermined period;

applying a beam of remote plasma RF nitrogen;

waiting a predetermined period; and

repeating application of the beams and waiting periods to produce the layer of AlN of desired thickness.

18. (Rejected) The method of claim 17 wherein the desired thickness of AlN is approximately 500 Angstrom.

19. (Rejected) The method of claim 17 wherein the beams last approximately two seconds each application, and the waiting periods are approximately two seconds.

Claims 20-30 (Canceled).

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.